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Flower anthers are removed from one parent plant in preparation for cross pollination in bean breeding program. See story on page 16.

Pour un programme de sélection du haricot de grande culture, on sectionne les anthères d'une des plantes parent pour la pollinisation croisée. Voir article en page 16.

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La revue trimestrielle *CANADA AGRICULTURE* renseigne les vulgarisateurs et représentants du négoce agricole sur les développements de la recherche et des autres services agricoles du gouvernement fédéral.

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Agriculture Canada

HYBRID VIGOR IN DAIRY CATTLE

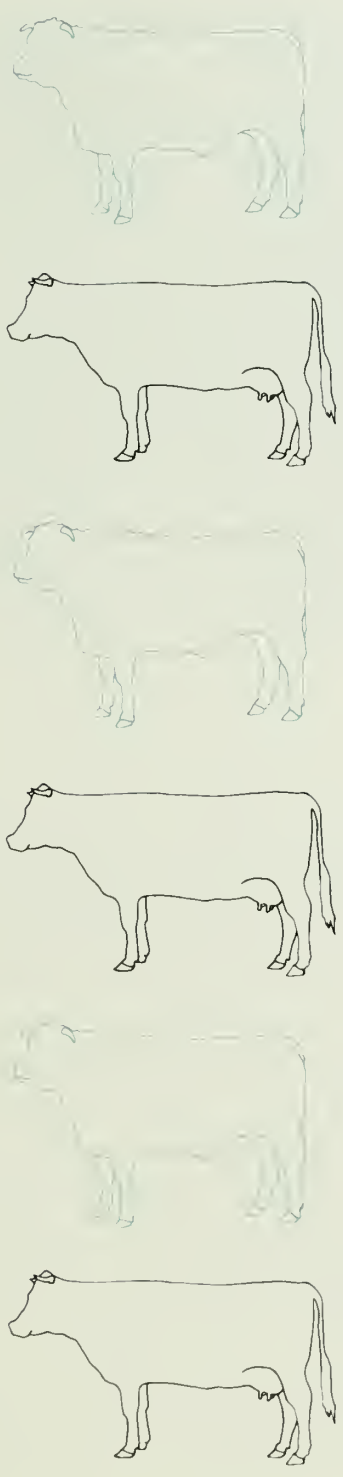
C. G. HICKMAN, J. P. F. DARISSE, J. A. B. EMSLEY, J. NAGAI, G. ROY, J. A. VESELY, K. A. WINTER, A. J. McALLISTER AND T. R. BATRA

Les spécialistes ont élaboré un nouveau programme de croisement à l'intention des bovins laitiers, qui, espèrent-ils, produira un nouvel hybride égal et supérieur à la race Holstein en ce qui a trait respectivement à la production laitière et à d'autres caractères.

Agriculture Canada has started a program for dairy cattle to produce a hybrid equal to the Holstein in milk production and superior in other characteristics. Research Stations located at Charlottetown, P.E.I., Lennoxville, Que., Lethbridge, Alta., and Normandin, Que., are cooperating with the Animal Research Institute at Ottawa on this study.

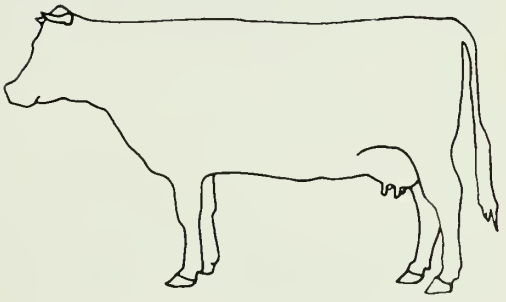
Will hybrid vigor (heterosis) increase productivity of dairy cattle as it has in other livestock? Female hybrids in swine, sheep or beef cattle often display superior ability to raise their offspring and to withstand the stress of reproduction. This maternal ability, however, is not as useful to the dairy industry because, under modern husbandry practices, dairy cows do not rear their own young.

But a hybrid could excel in other qualities. If two high-producing breeds are crossed, you would expect the female hybrids to be hardier, less subject to disease, longer-lived, and generally more profitable than cows of either of the parent breeds. Experience with other species suggests that hybrid dairy cows would have more calvings and more calves in a lifetime, and that the hybrid calves would have higher survival rates than those of the parent breeds. Better survival rates would tend to improve the hybrid line because more low-producing cows could be culled.



No matter what superior qualities could be gained by heterosis, a new hybrid would not be of commercial value unless it could at least match the Holstein in milk production.

Many countries have high-producing breeds that have never been tested under Canadian conditions of feeding and management. Agriculture Canada scientists knew that they could not import animals of all these breeds for their experiment; the enormous costs and veterinary restrictions on cattle imports made such an approach impractical. But they did arrange to import semen of some high-producing breeds for use in the breeding program.



The research herd of 800 milk cows (plus heifers and dry cows) is located at the five research stations. Initially half the herd was purebred Canadian Ayrshire and the other half was purebred Holstein. To obtain superior meat and milk

The scientists are with the Research Branch, Agriculture Canada, at Ottawa, Ont., Charlottetown, P.E.I., Lennoxville, P.Q., Normandin, P.Q., and Lethbridge, Alta.

production, semen from bulls of the Norwegian Red, Finnish Ayrshire, American Brown Swiss, Canadian and U.S. Ayrshires was used on Ayrshire females to form an A line population. Holstein cows were bred to selected Holstein bulls in U.S. and Canadian A.I. units to form an H line population.

The H line and A line animals are continuously improved by selection, principally for milk protein yield. The H line is crossed with the A line to create a crossbred population, the C line (see Figure 1.). C line females are mated to hybrid bulls (H X A and A X H) to propagate and improve the C line population. (This mating scheme, unlike many mating schemes for other species, would allow owners of hybrid herds to produce, rather than buy, their replacement hybrid females by using hybrid bulls if the scheme is adopted in industry.)

The breeding experiment has now progressed to matings between the H and A lines to form the foundation of the C line. The first C line females have freshened to services from H X A or A X H bulls.

The research team is beginning to assess the quality of the new hybrids, using such criteria as milk production, fat and protein content of the milk, veterinary costs, longevity, and overall profitability. Within one or two years, they will have sufficient evidence to judge the merits of the H, A, and C lines. More time will be needed to establish differences in longevity and overall profitability.

If this breeding program succeeds in demonstrating useful hybrid vigor in dairy cattle, the dairy industry will benefit. Breeders may try to exploit hybrid vigor as the scientists did, by crossing different breeds. Alternately, they can try crossing lines within a breed; for

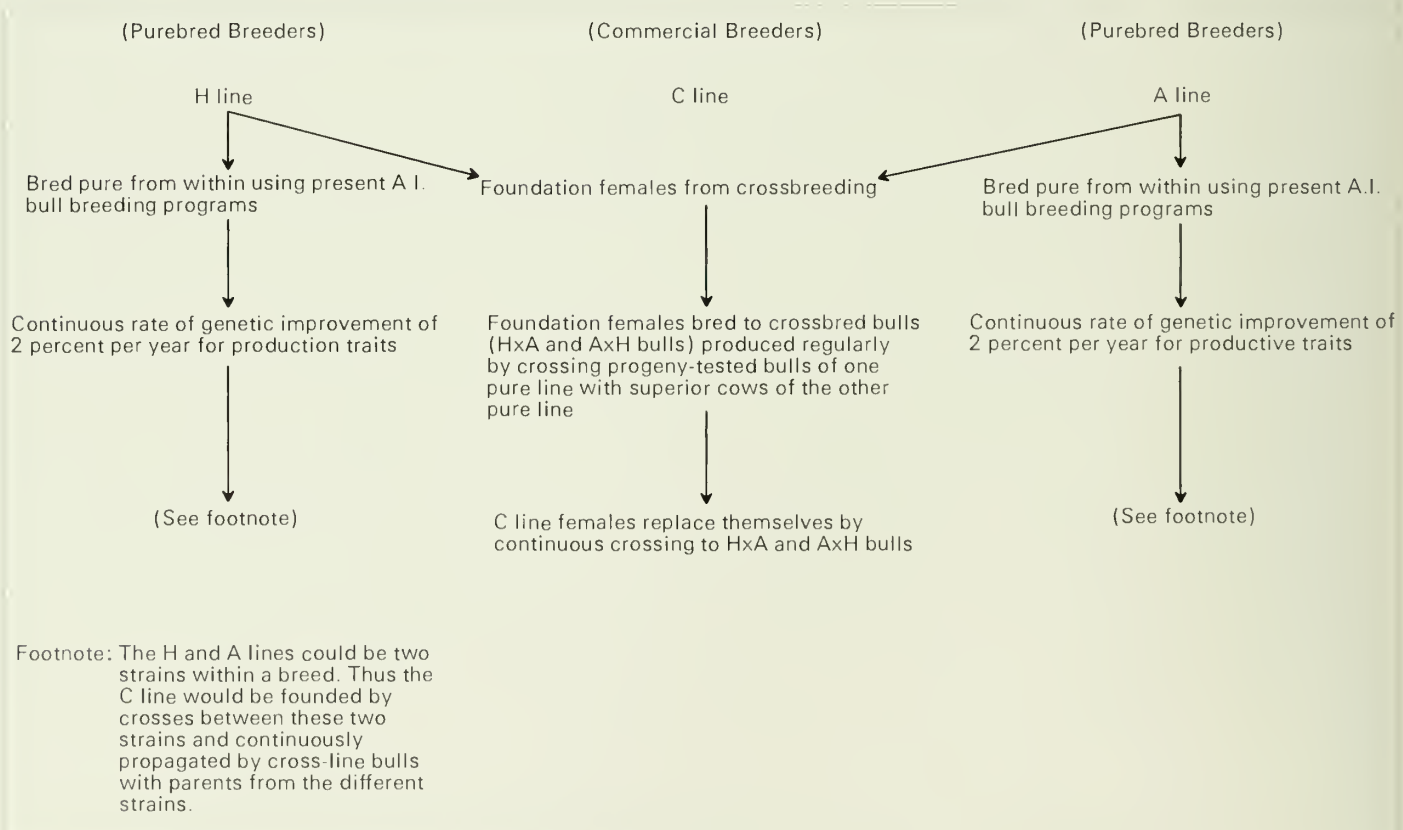
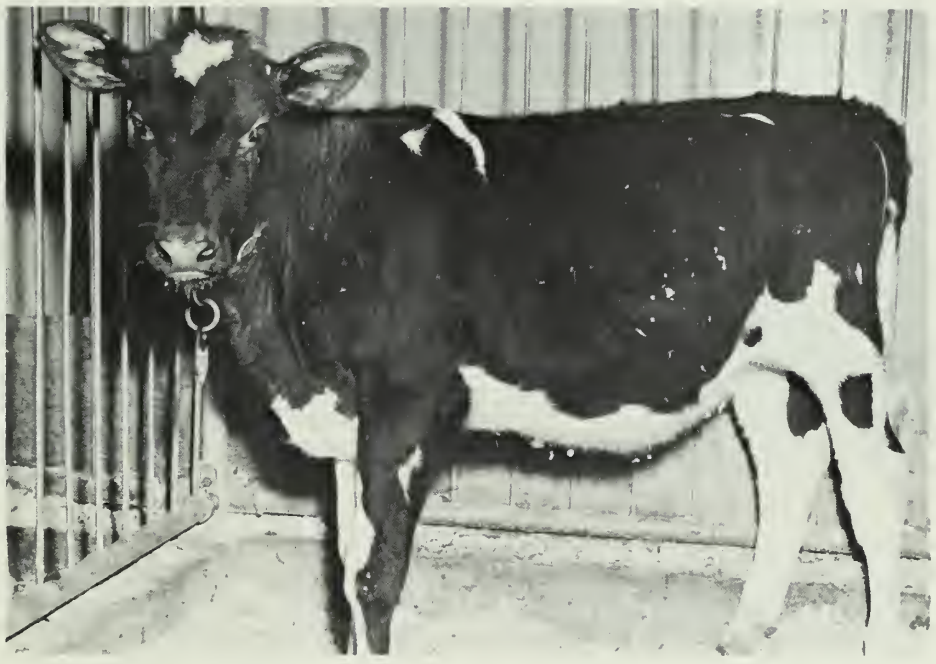


Figure 1. Mating scheme for utilizing hybrid vigor in a dairy cattle breeding program

example, Holstein breeders may be able to form strains of Holsteins and create C-line populations from these strains. Certainly, knowledge gained from the Research Branch breeding program will enable breeders to use A.I. to better advantage. ■



This C line calf was born at Agriculture Canada's Animal Research Institute, Ottawa.

BEEF SELECTION FOR GAIN ON TWO RATIONS

J. E. LAWSON

Les spécialistes en génétique animale de Lethbridge étudient actuellement les effets à long terme de la sélection en fonction des gains de poids réalisés, 168 jours après le sevrage, avec des rations à forte et à faible teneur énergétique.

J. E. Lawson is an animal geneticist at the CDA Research Station, Lethbridge, Alberta.

Many beef cattle breeders and test station operators use high energy grain rations to maximize gains in the feedlot portion of their performance test. Not only is that costly, but studies at CDA Research Substation, Manyberries, indicate that the practice is both unnecessary and unwise.

A project, the objectives of which are to assess the long-term effect of selection for 168-day postweaning gain, the influence of two levels of nutrition on that selection, and the effect of that selection on other traits, is now under way at Lethbridge, and is expected to produce more answers.

Foundation stocks from a cross-section of Alberta registered Angus and Hereford herds were purchased between 1959 and 1963. Two lines of 108 cows were established in each breed in 1963. To assure that

Fig. 1. Selected High-Plane Angus bull

Fig. 2. Selected Low-Plane Hereford heifers.

the lines within a breed were similar in genetic makeup, each of the 12 foundation sires within a breed was mated to nine cows from each line within that breed each year so that each sire had progenies in each line. Semen from each bull was stored for a later 2-year Interim Test.

Calves from one line of each breed are fed a High Plane (HP) ration from weaning time on November 1. When they go on full-feed, to promote rapid growth, the ration consists of: barley, 60 percent; oats, 10 percent; beet pulp, 10 percent; chopped alfalfa hay, 20 percent. A 30 Ca: 13 P supplement and cobalt-iodized salt are available free choice. Calves from the second line of each breed are fed a Low Plane (LP) ration (chopped hay, 18 Ca: 18 P supplement and cobalt-iodized salt free choice), which is intended to promote a relatively slow growth rate.

In all lines, the basis for selection is superior gain in the 168-day feedlot period immediately following weaning. Three yearling bulls and 18 to 21 yearling heifers from each line are selected as breeding replacements for that line each year. Cows are removed from the project at 7 years of age, after they have weaned their calves, unless the cows have to be retained to maintain line numbers. The response to selection can be estimated from records of: birth (calf) and calving (cow), weaning and feedlot data, linear body measurements of skeletal structure, ultrasonic measurements indicating area of and fat thickness over the rib eye muscle, fertility of both males and females, hair coat evaluations, milk production and constituents, and blood and enzyme constituents.

Each bull is mated to the same group of cows (repeat mating system) in each of the 2 years he is used on the project. Thus, because half of the bulls are replaced each year, the effects of environment from year to year can be estimated. A 2-year Interim Test, comparing the progenies of foundation bulls and those of bulls produced in calf crops 11 and 12 (1974 and 1975) was initiated in July 1976. Calves will be tested for growth rate to slaughter age, efficiency of feed utilization in the feedlot, and carcass quality. The results of those tests, comparing at one time the progenies of foundation sires and the sires produced after about three generations of selection will provide an estimate of genetic progress.

In a final test at the end of the study, half of the calves of each sex and line will be fed the HP ration and half will be fed the LP ration. Comparisons will reveal to what extent lines differ for each of several traits as a result of selection.

Among the 894 first-generation progeny of the foundation bulls and cows (before selection had been applied), Angus calves were lighter at birth, but heavier at weaning than Hereford calves. Hereford calves outgained the Angus on the HP ration during the 168-day feedlot test, but the breeds did not differ in gains made on the LP ration. At the conclusion of the feedlot test, when the majority of the calves were from 11 months to just over 12 months, the weight per day of age

Fig. 3. Brian McCarthy, CDA Livestock Division, using ultrasonic instrument to measure rib eye area and fat thickness.

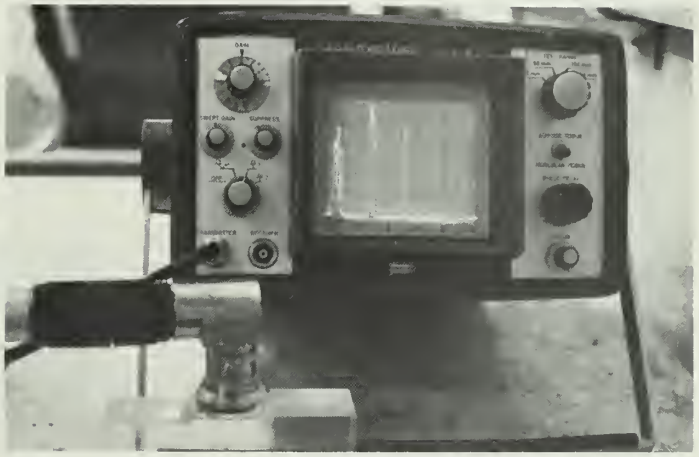


Fig. 4. Example of "blips" that indicate change between fat and lean.

(total weight/age in days) was identical for the two breeds on the HP and LP rations.

Each foundation sire was used in both lines within a breed. Progenies of the various sires did not differ in ranking for feedlot gain on the two different rations.

Some trends that are occurring are:

- Most of the digestive disturbances and deaths, and all of the founders, during the feedlot test occur among calves fed the HP ration.
- Selected bull and heifer calves from both HP and LP lines exhibit good fertility and can be bred successfully by 14 months of age.
- Within both age of dam and sex of calf subclasses, calves in the LP lines tend to gain at a faster rate from birth to weaning than calves in the HP lines.
- Preliminary milking tests indicate that cows from the LP lines tend to produce more milk than cows from the HP lines.
- Mature cows tend to be replaced sooner in the HP lines. The replacements are required predominantly because of death, disease, or failure to rebreed and presumably are caused by additional stress during the feedlot period.

Three additional areas of work being emphasized in the search for divergence in performance involve a comparison of lines for: (1) several blood and enzyme constituents (in the planning stage), (2) yield of milk and of fat, solids-not-fat, and protein in the milk (in the preliminary stage, and (3) rib eye area and fat thickness over the rib eye using ultrasonics on the live animal.

Ultrasonic measurements were taken by personnel of the Livestock Division, Production and Marketing Branch, Agriculture Canada. Bull calves were measured just after weaning on November 1 and just after the conclusion (April 18) of the 168-day feedlot test on the 8th and 11th calf crops.

The two lines within each breed did not differ in area of the rib eye at weaning before the rations could have an effect. However, the Angus line on the LP ration exceeded each of the Hereford lines and the Angus line on the HP ration also exceeded the Hereford line on the HP ration.

At the end of the 168-day test each of the HP lines surpassed each of the LP lines in both area of, and fat thickness over, the rib eye. None of the differences between breeds within rations were important.

Stress induced by the HP ration during the performance test is having immediate and long-term deleterious effects on the performance of these lines of cattle. Perhaps in the HP lines we are selecting animals that have a large appetite while in the LP lines we are selecting those that are efficient in feed utilization. When our selection program is completed, we will test the progenies of each line on both rations to determine further the effect we have had on the performance of lines. Then we hope to have complete answers to several questions — one of the most important being — "What are the consequences of selecting replacement cattle that have been performance tested on HP rations?" ■

STEER-HEIFER PRICE DIFFERENTIALS

H. T. FREDEEN

In past months, Alberta wholesale prices for A_1 beef carcasses have averaged 5% less for heifers than for steers. For the same period on the Calgary market the sex differential for live slaughter cattle of A_1-A_2 carcass grade expectation was 11% in favor of steers.

Such price discrimination against heifers is not unique to Alberta. It exists, and has existed traditionally, at all major livestock markets across Canada. Retail buyers claim that lower retail yield expectations justify reduced prices for heifer carcasses. Packer buyers, dealing with live animals, pass this wholesale price spread back to the producer along with an additional discount said to reflect lower expectations for dressing percentage and carcass grades.

Based on these arguments one would expect the price differential to be reasonably constant from month to month for any given market. Examination of monthly trends do not show such consistency (Figure 1). Since March 1974, the sex differentials applied in Alberta have ranged from 1 to 12% for A_1 carcasses and from 4 to 18% for A_1-A_2 slaughter cattle.

Trends in the sex differential applied to live cattle have roughly paralleled those in the wholesale carcass trade. However, during the period April to July 1974 when the wholesale differential ranged from 1 to 2% the live animal differential increased steadily from 4 to 18%. The latter figure (18%) was 9 times greater than the carcass differential for that month.

Dr. Fredeen is Head of Animal Science, Agriculture Canada Research Station, Lacombe, Alta.

The trends observed clearly establish that factors other than quantity-quality relationships are involved in establishing price differentials between steers and heifers. However, the important issue is to determine whether sex differences do exist in any quantitative or qualitative aspects and, if so, to identify the price differential warranted by such differences. This issue has been examined by analysis of data obtained in the course of comprehensive studies on 2434 beef carcasses conducted at the Lacombe Research Station.

The retail buyer deals only with carcasses. Further, the grading system describes carcasses according to weight and grade which are the two basic criteria used in retail buyer specifications. Thus the only sex comparisons of any relevance to the retail buyer are those made within each weight and grade class.

The most pertinent sex comparisons are those for A_1 and A_2 carcasses since these comprise the largest proportion (approximately 89%) of all carcasses in this quality grade. The sex comparisons for these two grade classes in the midweight range (500-699 pounds) show that heifer carcasses are not inferior to steers in yield of retail product (Table 1). Heifer carcasses were marginally lighter and had slightly larger rib eye areas. For carcasses of lighter and heavier weight ranges, A_1 heifers and steers were identical in retail yield and the sex difference for A_2 carcasses was less than the average yield difference between A_1 and A_2 steer carcasses.

Steers did provide a higher retail yield than heifers for the maximum fat class (A_4) of the light weight range. However, only 4 steer carcasses were available for this specific comparison. On average, retail yield decreased with increasing carcass weight.

The study also included detailed evaluation of quality attributes. No sex differences were observed be-

ÉCART DE PRIX: BOUVILLONS/TAURES

H. T. FREDEEN

Au cours des 27 derniers mois, en Alberta, les prix de gros des carcasses de taures A_1 étaient en moyenne 5% inférieurs à ceux des bouvillons. Pendant la même période, sur le marché de Calgary, les prix vifs des bovins d'abattage de catégories prévues A_1 et A_2 ont été en faveur des bouvillons (11%). Ce n'est pas qu'en Alberta que les bouvillons jouissent d'une plus-value au détriment des taures. Les principaux marchés à bestiaux du Canada ont toujours enregistré ce genre d'écart de prix. Les détaillants avancent qu'un rendement inférieur net attendu au détail justifie cette dépréciation des taures. Les abattoirs, qui achètent sur pied, transmettent ce prix de gros aux producteurs et accordent un rabais supplémentaire tenant compte du plus faible rendement prévu à l'abattage et au classement des carcasses.

Cette ligne de conduite laisse supposer que les écarts de prix sont passablement constants d'un mois à l'autre sur tous les marchés. Par contre, l'étude des tendances mensuelles ne démontre pas une telle stabilité (figure 1). Depuis mars 1974, les écarts des prix en Alberta ont varié de 1 à 12% pour les carcasses A_1 et de 4 à 18% pour les bovins d'abattage A_1 et A_2.

Chez les bovins vivants, l'écart attribuable au sexe était passablement analogue à celui du prix de gros des carcasses. Toutefois, au cours de la période d'avril à juillet 1974, la différence entre les prix de gros a oscillé de 1 à 2%, mais l'écart des prix des animaux a régulièrement augmenté de 4 à 18%; cette hausse (18%) était donc 9 fois supérieure à celle du prix des carcasses.

Les tendances observées démontrent indubitablement que les facteurs autres que le rapport «quantité/qualité» influent sur l'écart des prix des bouvillons et des taures. Cependant, il s'agit avant tout de déterminer si cette discrimination existe vraiment sur le plan quantitatif ou qualitatif et, s'il en est ainsi, d'évaluer l'écart des prix attribuable au sexe. Le dépouillement des données obtenues au cours des études globales effectuées sur 2434 carcasses de bovins à la Station de recherche de Lacombe, a permis d'examiner la question.

Les détaillants n'achètent que des carcasses. En outre, dans le système de classement les carcasses sont évaluées en fonction du poids et de la catégorie, soit les deux principaux critères évoqués par les détaillants. Ainsi, les seules comparaisons pertinentes au détail ont trait au poids et à la catégorie des carcasses de bouvillons et de taures.

Les comparaisons les plus pertinentes portent sur les catégories A_1 et A_2, dans lesquelles sont classées presque toutes les carcasses (environ 89%). Les comparaisons entre ces deux catégories de poids moyen de (500 à 699 lb) révèlent que le rendement au détail n'est pas inférieur à celui des bouvillons (tableau 1). Les carcasses des taures étaient à peine plus légères cependant, mais la surface du profil vertébral transversal légèrement plus grande. Dans les catégories de carcasses de poids plus léger et plus lourd, le rendement au détail des bouvillons et des taures A_1 était identique et l'écart attribuable au sexe des carcasses A_2 était inférieur à la différence entre le rendement moyen des carcasses de bouvillons A_1 et A_2.

Le rendement au détail des bouvillons des catégories de classe de gras maximum (A_4) de faible poids surpasse celui des taures. Toutefois, on ne disposait que de quatre carcasses de bouvillons pour établir cette comparaison. En moyenne, les rendements au détail, diminuent avec l'augmentation du poids de la carcasse.

L'étude a aussi porté sur une évaluation précise des aspects qualitatifs. On n'a relevé aucune diffé-

Le Dr Fredeen est le Chef de la Station fédérale de recherches zootechniques de Lacombe (Alberta).

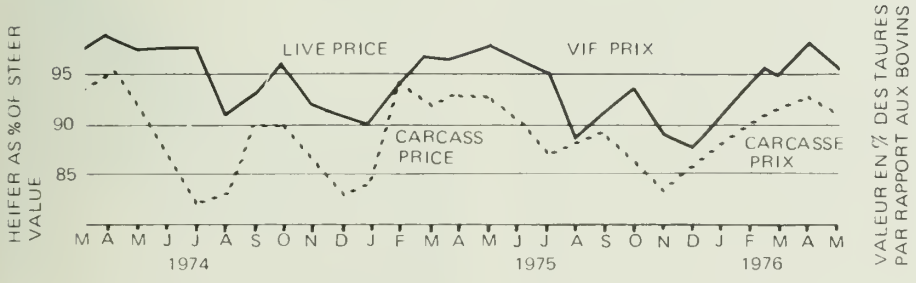


Figure 1. Heifer prices, live and carcass, as a percent of price paid for steers of equivalent grade

Figure 1. Prix des taures et des carcasses, % du prix des bouvillons de catégorie analogue

TABLE 1 SEX DIFFERENCES IN QUANTITATIVE CARCASS TRAITS FOR A_1 AND A_2 CARCASSES OF THREE WEIGHT RANGES

Weight	Fat class	Steer averages				Sex difference (steer-heifer)			
		Carcass wt (lb)	Graded fat (in.)	Rib eye area (sq in.)	Retail yield %	Carcass wt (lb)	Graded fat (in.)	Rib eye area (sq in.)	Retail yield %
400-499	A_1	462	.39	10.23	69.5	+ 3	− .02	− .26	−0.2
	A_2	467	.50	9.65	68.3	+16	− .06	− 49	+1.8
500-699	A_1	576	46	11.70	69.1	+19	0	− .12	+0.2
	A_2	596	.61	11.17	66.8	+32	− .03	− .07	−0.1
	A_1	750	.56	13.54	68.5	−42	− .01	−2 46	0
	A_2	730	.64	12.68	65.9	+ 6	− .04	−1 44	+1.9

TABLE 2 SEX DIFFERENCES IN DRESSING PERCENTAGE FOR A_1 AND A_2 CATTLE OF THREE WEIGHT RANGES

Weight range (lb)	400-499		500-699		700+	
Fat class	A_1	A_2	A_1	A_2	A_1	A_2
Steer dressing %	58.4	58.8	59 6	59.3	61 0	61.6
Sex difference (steer-heifer)	−1.2	+0.7	−0.2	−0.4	−3 1	+1.4

tween sexes within fat class or between fat classes. However, no differences were expected since any carcass of either sex which deviated from normal quality expectations would have been assigned to a different quality grade. Quality characteristics were unaffected by carcass weight.

From these results it is evident that a price differential between steer and heifer carcasses of the same weight and grade class cannot be justified on quantitative or qualitative aspects.

The primary sex differences relevant to dressing percentage are in weight of hide, head and feet (heifers lighter), internal organs (heifers heavier due to differences in reproductive tract) and body cavity fat (heifers greater). However, in comparisons based on large numbers of slaughter animals, these differences tend to balance out. Thus in the current study the sex difference in dressing percentage for animals producing carcasses in the mid weight range was small and in favor of heifers (0.2% for A_1 and 0.4% for A_2 carcasses). This sex difference was reversed only for animals producing A_2 carcasses in the light and heavy weight ranges (Table 2).

It is clear from this evidence that dressing percentage is not a valid basis for price discrimination against slaughter heifers when the sexes are purchased according to weight and potential carcass grade. For gate run cattle, however, consideration must be given to the fact that dressing percentage increases with increasing carcass weight (Table 2). Thus heifers, being relatively more numerous in the light weight class, may on average tend to dress less than steers. An estimate of the sex difference expected in gate run

...differences attribuables au sexe

Tableau 1 DIFFERENCES ATTRIBUABLES AU SEXE DANS LES ASPECTS QUANTITATIFS DES CARCASSES A_1 ET A_2 DE TROIS CATEGORIES DE POIDS

Catégorie de poids	Classe de gras	Moyenne des bouvillons				Différences attribuables au sexe (bouvillons/taures)			
		Poids de la carcasse (lb)	Gras (po)	Profil vertébral transversal (po^2)	Rendement au détail (%)	Poids de la carcasse (lb)	Gras (po)	Profil vertébral transversal (po^2)	Rendement au détail (%)
400-499	A_1	462	.39	10.23	69.5	+ 3	− .02	− .26	−0.2
	A_2	467	.50	9.65	68.3	+16	− .06	− .49	+1.8
	A_1	576	.46	11.70	69.1	+19	0	− .12	+0.2
	A_2	596	.61	11.17	66.8	+32	− .03	− .07	−0.1
	A_1	750	.56	13.54	68.5	−42	− .01	−2.46	0
	A_2	730	.64	12.68	65.9	+ 6	− .04	−1.44	+1.9

rence attribuable au sexe dans la classe ou entre les classes de gras et ne prévoyait pas en relever étant donné que toutes les carcasses qui dérogeaient des normes qualitatives normales devaient être classées dans une autre catégorie. Le poids de la carcasse n'affecte pas les particularités qualitatives.

Ces conclusions permettent d'établir que l'écart des prix entre les carcasses de bouvillons et celles des taures de même poids et de même catégorie ne peut être justifié du point de vue qualitatif et quantitatif.

Ces principales différences du rendement à l'abattage existent au niveau de poids de la peau, de la tête et des pattes (plus légers chez les taures), les organes internes (plus lourds chez les taures à cause de la différence des organes reproducteurs) et du gras des cavités viscérales (plus important chez les taures). Cependant, les comparaisons effectuées sur un grand nombre d'animaux abattus prouvent que ces écarts tendent à varier. Ainsi, dans le cadre de la présente étude, l'écart du rendement à l'abattage des animaux de carcasses de poids

TABLEAU 2 DIFFERENCES ATTRIBUABLES AU SEXE DANS LE RENDEMENT A L'ABATTAGE DES BOVINS A_1 ET A_2 DE TROIS CATEGORIES DE POIDS

Catégorie de poids (lb)	400-499	500-699	700+
Classe de gras	A_1 A_2	A_1 A_2	A_1 A_2
Rendement à l'abattage	58.4 58.8	59.6 59.3	61.0 61.6
Différences attribuables au sexe (taures-bouvillons)	−1.2 +0.7	−0.2 −0.4	−3.1 +1.4

moyen variait peu et était en faveur des taures (0,2% chez les carcasses A_1 et 0,4% chez les A_2). L'écart était inversé seulement chez les animaux de carcasses A_2 de la catégorie des poids légers et lourds (tableau 2).

Ces données prouvent que le rendement à l'abattage ne justifie pas la discrimination des prix des taures d'abattage lorsque des animaux de sexe différent sont achetés en fonction du poids et de la catégorie prévue de la carcasse. Cependant, dans le cas des bovins tout venant, il faut tenir compte que le rendement à l'abattage augmente en fonction du poids de la carcasse (tableau 2). Par conséquent, étant donné que l'on retrouve plus de taures que de bouvillons dans la classe des poids légers, leur rendement moyen peut être parfois inférieur. La moyenne obtenue pour tous les poids et catégories mentionnées dans la présente étude permet d'évaluer l'écart prévu chez les bovins tout venant, (0,23% en faveur des bouvillons).

L'échantillon total de l'étude permet aussi d'évaluer le classement prévu des bovins tout venant des deux sexes. Les taures produisent plus (44,0%) de carcasses de poids légers que les bouvillons (14,6%); le rapport chez les carcasses de poids moyens et lourds était analogue bien que réduit. Les taures tout venant ont aussi tendance à afficher un meilleur état d'engraissement que les bouvillons (21,3% par rapport à 8,3% se classent dans la catégorie A_4). Ces différences de répartition relative ont donné par rapport à tout le cheptel un écart

cattle is provided by averaging across all weight and grade classes in the present study. This difference was found to be 0.23% in favor of steers.

Grading expectations for gate run cattle of the two sexes may also be estimated from the total sample in this study (Table 3). A greater proportion of heifers (44.0%) than steers (14.6%) produced carcasses in the light weight range with a correspondingly smaller proportion in the mid and heavy weights. Gate run heifers also tended to carry more finish than steers with 21.3 vs 8.3% grading A_4. These differences in relative distribution resulted in an average sex difference of 1.21% in retail yield over the whole population (steers greater than heifers).

The packer buyer, in establishing a bid price for gate run slaughter steers, must be cognizant of the value he will receive for the carcasses produced. This will be determined by weight (carcasses 500-699 pounds preferred, quality grade (A > B) and fat class (reduced yield and value of retail products as fat increases). Using the wholesale values currently quoted in the trade it is possible to calculate the average value per cut for the steers represented in the gate run sample of Table 3. Assuming that steer and heifer carcasses have the same potential value to the retail trade, and no other assumption is valid in view of the research evidence, permits a similar calculation of the average value per cwt of gate run heifers. Comparison of the steer and heifer values after adjustment for differences in dressing percentage indicates that a realistic sex differential for gate run cattle would be of the order of 2.7% of steer price. Thus on a $40.00 market for steers, heifers would be priced at $38.92 per cwt live weight.

TABLE 3 GRADING EXPECTATIONS FOR GATE RUN CATTLE EXPRESSED AS THE PERCENTAGE OF EACH SEX PRODUCING CARCASSES OF SPECIFIC WEIGHT AND GRADE CLASSES

Sex	Carcass wt (lb)	A_1	A_2	A_3	A_4	B	Total
Heifers	<500	9.7	11.6	8.1	11.4	3.2	44.0
	500-699	23.6	12.8	7.9	9.9	1.2	55.4
	>699	0.2	0.4				0.6
	Total	33.5	24.8	16.0	21.3	4.4	
Steers	<500	5.5	4.7	1.5	0.4	2.5	14.6
	500-699	30.7	25.1	11.6	7.1	4.5	79.0
	>699	2.5	1.6	1.1	0.8	0.4	6.4
	Total	38.7	31.4	14.2	8.3	7.4	

This estimate relates only to gate run slaughter cattle. When sorted into groups based on live weight and anticipated grade the price differential should be zero.

In years past carcass grading standards tended to encourage excessive finish, particularly with heifers. As a result, slaughter heifers carried more body cavity fat than steers and produced carcasses with greater exterior fat cover. These were sound reasons for the traditional view that heifers were inferior to steers in dressing percentage and potential retail yield.

The basic change in carcass grade standards incorporated in the 1972 grade standards revision was the subdivision of each quality grade into fat classes based on actual measurements of fat cover. Carcass prices in the wholesale trade were quick to reflect the differences in retail yield expectations for the various fat classes and producers responded to the price incentives by reducing the average fatness of slaughter cattle. While this has improved the retail yield of both sexes the greatest change has occurred with heifers.

Today, the sex differences in dressing percentage and retail yield of gate run steers and heifers are relatively small. Of greater importance, however, is the fact that sex differences in yield do not exist among carcasses of the same weight, grade and fat class. Since research has also established that sex of carcass is not relevant to product quality it follows that the buyer of carcasses may confidently ignore sex provided weight, grade and fat class are specified. ■

moyen de 1,21% du rendement au détail (les bouvillons étaient plus nombreux que les taures).

En fixant un prix aux enchères des bouvillons d'abattage tout venant, l'abattoir doit connaître le prix qu'il obtiendra des carcasses. Le prix sera déterminé en fonction du poids (carcasse de 500 à 699 lb de préférence, catégorie (A > B) et de la classe de gras (le rendement et la valeur du produit au détail diminuent et au fur et à mesure que la couverture de gras augmente). Les publications régulières des prix de gros du marché permettent de calculer la valeur moyenne d'une partie de bouvillon représenté à l'échantillon (tout venant) du tableau 3. Supposant que les carcasses de bouvillons et de taures ont la même valeur potentielle au détail, et que les recherches n'amènent aucun autre indice valable, il est possible de calculer de la même façon la valeur moyenne des 100 lb de taure tout venant. La comparaison entre la valeur des bouvillons et des taures, après ajustement des différences du rendement à l'abattage, révèle que l'écart réel attribuable au sexe des bovins tout venant représenterait 2,7% du prix des bouvillons. Donc, lorsque les bouvillons se vendraient $40, le prix des taures serait fixé à $38.92 les 100 lb (poids sur pied). Cette évaluation ne touche que les bovins d'abattage tout venant. Lorsqu'ils sont classés par groupe en fonction du poids vif et de la catégorie prévue, l'écart des prix devrait être de zéro.

Au cours des années passées, les normes de classement des carcasses tendaient à favoriser, surtout chez les taures, un état d'engraissement excessif. Par conséquent, le gras des cavités viscérales était plus considérable chez les taures que chez les bouvillons et la couverture extérieure de gras des carcasses plus épaisse. Ces raisons valables justifiaient l'infériorité du rendement à l'abattage et du rendement prévu au détail des taures par rapport aux bouvillons.

TABLEAU 3 CLASSEMENT PREVU DE BOVINS TOUT VENANT, EXPRIME EN % DE CHAQUE SEXE PRODUCTEUR DE CARCASSES DE POIDS ET DES CATEGORIES PARTICULIERES

	Poids de la carcasse	A_1	A_2	A_3	A_4	B	Total
Sexe	<500	9.7	11.6	8.1	11 4	3 2	44.0
Taures	500-699	23.6	12.8	7 9	9.9	1.2	55.4
	>699	0.2	0.4				0 6
	Total	33.5	24 8	16 0	21.3	4 4	
Bouvillons	<500	5.5	4 7	1 5	0.4	2 5	14 6
	500-699	30.7	25.1	11.6	7.1	4.5	79.0
	>699	2.5	1.6	1.1	0.8	0 4	6 4
	Total	38.7	31.4	14 2	8.3	7.4	

Lors de la révision des normes de classement (1972), la modification principale a porté sur la subdivision de chaque catégorie de qualité en classe de gras évaluée d'après l'épaisseur réelle de la couverture de gras. Les prix de gros des carcasses ont rapidement tenu compte des différences du rendement prévu au détail pour les diverses classes de gras et les producteurs ont réagi à la hausse des prix en réduisant l'épaisseur moyenne de la couverture de gras des bovins d'abattage. Tout en améliorant les rendements au détail des carcasses des deux sexes, cette modification a surtout favorisé celui des taures.

Aujourd'hui les écarts attribuables au sexe dans le rendement à l'abattage et au détail des bouvillons et taures tout venant sont relativement mineurs. Cependant, il s'impose avant tout de souligner la disparition des écarts de rendement des carcasses de même poids, catégorie et classe de gras. Puisque les recherches ont aussi démontré que le sexe de la carcasse n'influe pas sur la qualité du produit, dorénavant les acheteurs de carcasses peuvent en toute confiance ignorer le sexe si le poids, la catégorie et la classe de gras sont mentionnés. ■

COMPUTER-ASSISTED LITERATURE SEARCHES

ARLEAN McPHERSON

Grâce à l'ordinateur, les chercheurs de la Station fédérale de recherches de Saskatoon bénéficient d'un accès rapide à la documentation sur le colza, la moutarde et les autres oléagineux. Plus de 7 000 titres sont consignés et de l'avis des usagers, la banque a atteint une envergure et une qualité suffisantes pour profiter aux chercheurs de domaines connexes à d'autres centres.

Compilation of extensive and well-indexed documentation is one aspect of library activity supporting development of such new rapeseed varieties as the one being examined by Dr. R. K. Downey.

Several years ago, to cope with the quantity of research publications in their subject area, oilseeds breeders at the Agriculture Canada Research Station in Saskatoon approached their librarian for help. They asked for a comprehensive file covering rapeseed, mustard and associated oilseeds, to provide efficient, in-depth access to the collection. Five researchers at that time believed that such an arrangement would eliminate duplication of effort in procuring reprints, afford broader and more intensive coverage than was locally available, facilitate the physical storage and location of papers, and expedite speedy literature searches. These goals have now been met. More than 7,000 items including reprints, conference papers and technical reports, are on file. And more important, documents on specific subjects are readily retrieved by individually-tailored computer search. To a large extent, the file has superseded personal document collections previously maintained by the researchers themselves.

Three basic policies govern the project. First, documentation is collected primarily to satisfy the information requirements of the Saskatoon station oilseeds research team under Dr. R. K. Downey. This collection, at first, gave priority to such aspects as rapeseed breeding, oil quality, glucosinolates, and fatty acid analysis. However, as local interests and emphases modified, the complexion of the file changed to accommodate such other aspects as protein content and quality, cytogenetics, tissue culture techniques, and sunflower production. And despite the above-mentioned concentrations, it does range broadly in related areas such as animal nutrition, oilseeds processing, plant diseases and agronomy.

Second, access to the file is computer-assisted. As each item is received, bibliographic data and indexing information is keypunched for processing by FAMULUS, a software developed at the Pacific Southwest Forest and Range Experiment Station in Berkeley. FAMULUS is described by its creators as a system designed to support the documentation activities of individual scientists; and it offers the user editing, sorting, indexing, searching and file-revision features in a package sufficiently flexible to meet our oilseed team requirements. Each paper is coded under six fields — author, title, date of publication, journal or other source, descriptive keywords, and in-house location — any one of which may be searched either singly or in combination. Should additional fields, such as one

Arlean McPherson is the librarian, Agriculture Canada Research Station, Saskatoon, Sask.

Dr. A. J. Klassen, plant breeder, and Dr. D. I. McGregor, biochemist, request personally-tailored computer searches while referring to hard copy with their librarian, Miss A. McPherson.

J. R. Brownridge, assistant librarian, checks author-sorted printout of the Brassicas/Oilseeds file at the station terminal.

for abstracts, be required in future, FAMULUS permits their insertion.

Third, index terms are assigned using standardized vocabulary. This required local compilation of a *Thesaurus of Descriptors*, the latest revision of which runs to 92 typed pages. As well as authorizing keywords for use in indexing, the thesaurus also indicates their hierarchical relationships with broader, narrower and related terms, and refers indexers from unacceptable synonyms to authorized descriptors. Use of the standardized indexing vocabulary supplements the author and/or keyword-in-title searches otherwise possible with FAMULUS, and permits the generation of indexed bibliographies.

To date, the document collection and machine-searchable index have provided valuable support to the station's oilseeds breeding program. Plant breeders, biochemists, cytogeneticist, agronomist and phytopathologist have turned to the computer for literature searches on such widely-assorted subjects as rape residues, goitrogens, rapeseed meal in animal nutrition, brassica seed size, glucosinolate biosynthesis, and alternaria; and feel that, although small, the data base is now of a quality to be of major assistance to researchers working in similar fields in other centres.

Of related interest is a second, smaller file, recently initiated by the library at the request of Dr. L. Burgess on insect pests of oilseeds. In it, major emphasis is on flea beetles, bertha army worm and the diamondback moth. ■

WHITE BEAN BREEDING IN CANADA

J. W. AYLESWORTH

Plusieurs lignées de haricots issues du Programme d'amélioration et d'essais à Harrow (Ontario) offrent des promesses sur les plans du rendement, de la résistance aux maladies et de la précocité.

White beans, pea beans or navy beans were grown commercially on approximately 140,000 acres in southern Ontario in 1976 and also on small acreages in Manitoba, Alberta, Quebec and Prince Edward Island. Farm returns in Ontario were approximately 30 million dollars in 1975. Over 70% of the commercial crop in Ontario is exported each year, mainly to Great Britain and other parts of Europe. Markets are being developed also in several other countries.

White beans are one of many dry edible bean types known as *Phaseolus vulgaris* L. Red and white kidney beans, pinto beans, yellow-eye beans, red mexican, black turtle, great northern beans and the many varieties of wax and green beans belong to this group as well. Beans are grown throughout the world as a protein source and are an essential food item, particularly in developing countries.

The white bean industry in Canada is concentrated mainly in five counties in southwestern Ontario where soil and climatic conditions are ideal for dry bean production. Of particular importance are the weather conditions in the fall which allow harvest of the crop with a minimum of weather damage. Similar conditions prevail in Michigan, U.S.A., where approximately 550,000 - 600,000 acres of white beans (navy beans) are grown annually. Therefore, continuing research is necessary to help the bean industry in Canada to maintain a competitive position in world trade.

Bean selections are screened in the greenhouse for resistance to bean common mosaic virus. A control variety, Pinto shows severe disease symptoms in inoculated plants on the right as compared with non-inoculated plants on left.

White bean breeding at the CDA Research Station, Harrow, is to develop new varieties with higher seed yield, more erect type of growth and improved resistance to economically important diseases such as bean common mosaic, anthracnose, common blight and root rot. The program involves a plant breeder and plant pathologist with input from entomology, plant physiology and chemistry disciplines as required. The Ontario Colleges of Agricultural Technology at Ridgetown and Centralia, and the University of Guelph test new selections and varieties on a regional basis in cooperative field performance trials. The program was reorganized and accelerated in 1968 to meet urgent requirements of the industry. The higher yielding Harrow variety, Kentwood, was released in 1973 and has received favorable acceptance by growers in Ontario and is gaining recognition in the U.S.A.

Several advanced selections from the breeding program at Harrow have shown promise in tests across southwestern Ontario. Average performance data in 15 tests during the three years 1973-75 are shown in Table 1.

Dr. Aylesworth is in charge of white bean breeding at Agriculture Canada's Research Station, Harrow, Ont.

Table 1 PERFORMANCE OF ADVANCED WHITE BEAN SELECTIONS IN REGIONAL TRIALS IN SOUTHWESTERN ONTARIO (AV 15 TESTS OVER 3 YEARS, 1973-75).

Selection or variety	Seed yield cwt/acre	Days from planting to maturity	Gms/100 seeds
74F1-2	24.1	103	17.5
82A3-1-1	24.3	98	17.3
82B4-1	22.7	104	18.8
94C2-3	23.1	104	18.9
Sanilac	19.8	89	17.1
Seafarer	18.8	86	18.4
Kentwood	21.2	88	20.7

Seed yields of the four numbered selections shown in Table 1 were significantly higher than Sanilac, Seafarer and Kentwood, the varieties presently recommended for Ontario. Although these selections are 10 to 16 days later in maturity than Kentwood, they have matured satisfactorily in field trials in southern Ontario. In view of this we believe that one or more of these selections will be of value in Kent and Elgin counties where earlier planting would offset later maturity. Seed size of the new selections is comparable to Sanilac and Seafarer and is acceptable to the trade. The selections have resistance to races 1 and 15 of bean common mosaic and to the alpha, beta and gamma races of bean anthracnose. They are a little less upright than Kentwood and would require more care in harvesting. Strains that are earlier than Kentwood are being selected to fill a need for early maturing varieties in Ontario and other parts of Canada.

Good sources of resistance to bean common mosaic and anthracnose are available. All new selections are screened in the greenhouse using artificial inoculations of the different races of these diseases. It is desirable that any new varietal releases be resistant to mosaic and anthracnose.

Seed of promising selections is increased to provide a supply of beans for cooking quality tests by major food processors in Canada and the U K.

We are attempting to obtain resistance or tolerance to common blight using the great northern type of resistance developed by researchers in Nebraska. Selections are screened in the greenhouse using a multiple needle method of inoculation and in the field using a high pressure spray to force the inoculum into the leaf tissue. A number of selections have been made which have tolerance to blight equal to that of the resistant parent, but plant type, seed size and shape, and maturity are not suitable for commercial production. More work is required to incorporate blight tolerance into adapted varieties having characteristics acceptable to the trade. Common blight is presently being controlled in the commercial crop with the use of pedigreed seed derived from Breeder Seed grown in Idaho under dryland conditions and furrow irrigation.

Sclerotinia mold (white mold) is a fungal disease which can cause severe damage to the bean crop during excessively wet weather, particularly where growth is rank and the foliage has filled in between the rows. Good genetic sources of resistance to sclerotinia mold are not available; however, fungicide spray schedules have been developed which give adequate control of this disease. When available, sources of resistance will be included in the breeding program.

All new varieties must meet rigid standards for cooking quality before being released for production in Ontario. To ensure this, advanced selections are screened in the food processing laboratory at Harrow by taste panels who score the canned product for flavor, texture and appearance. In addition, quantities of seed of proposed varieties are sent to the major food processors in Canada and the U.K. for final evaluation. All of these assessments as well as field performance data are considered before a variety is licensed for use in Canada. ■

A "BLUE TAG" OPERATOR

D. W. MacDONALD

Une exploitation familiale constituée en société, située à Brussels (Ontario), a recours au service d'appréciation des carcasses de bœuf du Ministère pour améliorer la qualité des carcasses et le croît de ses bovins: elle pratique à cette fin une meilleure sélection des reproducteurs.

Carcass quality can mean a lot to the beef producer. Whether he has breeding stock, or cattle for slaughter, it's the carcass, or meat, that counts. Packers and consumers buy meat on quality, and they pay high prices only on the best grades.

Fortunately, carcass quality has a high degree of heritability. Knowing the kind of carcasses their animals produce, cattlemen can upgrade their stock through better selection of breeding animals, and feeding methods.

But it's not easy to get the right kind of data on carcasses. Normally, carcasses can't be measured or graded until the animal has been slaughtered. Instruments that measure the fat and lean content of live cattle ultrasonically are proving useful in carcass appraisal but this technique is not generally available to individual producers at this time.

That brings up Agriculture Canada's Blue Tag program. This Beef Cattle Carcass Appraisal Service gives cattle owners information on grade, carcass weight, fat thickness, ribeye area, marbling and cutability estimate on all cattle bearing a Blue Tag and slaughtered at an authorized plant. Cattlemen apply to the Grading Officer in Charge at any one of eight Livestock Division offices across Canada, or the Livestock Division, Agriculture Canada, Ottawa. Owners are issued blue, numbered plastic ear tags, at $1 per tag, for animals destined for slaughter. Graders record the data at the plant and the information is forwarded to the owner for his use.

A blue tag in the ear of a slaughtered animal indicates that the owner requires carcass data.

Close to 52,000 Blue Tags were sold to producers up to August 31, 1976, since the program started in January 1972. See the accompanying table for a breakdown by provinces.

Bodmin Limited, an incorporated family farm at Brussels, Ont., owned and operated by Charles, Ross and George Procter, have used the service extensively to improve their breeding selection.

"We're looking for meatiness and high cutability as well as fast economical growth in commercially grown registered stock", Ross Procter declares. "We test a large group of purebred Shorthorn calves from our own cow herd as well as Shorthorn calves purchased from other breeders. In addition, we purchase calves of most other breeds and crosses at weaning time. These are housed and tested with the Shorthorn calves to observe the effect of breeding on rate of gain and carcass quality."

Procters received Blue Tag data recently on a group of 58 bulls fed on after being performance tested and marketed as meat. These animals graded 41 - A1, 14 - A2, 1 - A3 and 2 - B1.

The table below shows a summary for the group:

	Average	Highest	Lowest
Age in days	438	509	357
Hot carcass weight	678	916	518
Minimum fat (in.)	.42	.70	.10
Average of 3 fat levels	.54	.83	23
Rib eye area (sq in.)	12.06	19 25	9 75
Est. of cutability (%)	57.6	64 4	54 5
Average daily gain (lb)	3.1	4 68	1 92
365 day weight	934	1224	557

Mr. MacDonald is Head, Periodicals Services Unit, Information Division, Agriculture Canada, Ottawa.

The figures show the range of variability in carcass quality in this group of bulls and allow the breeder to zero in on the effect of breed of sire and dam on the carcass.

The Procters' purebred Shorthorn cow herd of about 120 animals dates back to their grandfather's time in 1923. All bulls and heifers in the herd have been performance tested in groups since 1968. Animals on test are grouped according to weaning date, and are fed, free choice, a relatively high energy ration of shelled corn with a pelleted protein supplement.

Bulls and heifers are weighed off the official Federal-Provincial R.O.P. Beef Cattle Performance testing program by a government weigh man. The lower indexing bulls are fed on to be marketed as beef at about 1100 pounds liveweight while the superior gainers are offered as herd sires for purebred and commercial stockmen to use in pure or crossbreeding programs.

Herd replacements for the cow herd are selected from the higher indexing heifers.

Up to September 1976 Ross Procter had performance records on about 1400 bull and heifer calves. He also has carcass data on about 325 animals through participation in the Blue Tag program.

Blue Tags sold to producers from January 1972 to August 31, 1976.

PROVINCE	
Atlantic Prov.	810
Quebec	2,201
Ontario	1,711
Manitoba	11,822
Saskatchewan	4,621
Alberta	22,928
B.C.	1,700
	51,793

Procters buy good bull and heifer calves to complete their test groups and give them a basis for breed comparisons. They have records on many breeds since 1972, including Hereford, Charolais, Simmental, Limousin, Chianina, Santa Gertrudis, Maine Anjou, Lincoln Red, Holstein, Galloway, Ayrshire and Angus.

One Shorthorn bull from a group tested and Blue Tagged in 1976 had the following record:

Carcass weight (lb)	740
Rib eye area (sq in.)	15.00
Average backfat (in.)	0.4
Minimum backfat (in.)	0.33
Estimate of cutability (%)	61.2

This type of individual record means something to Ross Procter who can identify the sires and dams that produce the meaty carcasses and use them in his breeding program. However he would like to see more analyses of the data from the Blue Tag program. He would like to see the government work out averages by weight groups and grades to serve as comparisons for others who use the Blue Tag program. For example, if all Blue Tagged AI carcasses within a weight range of 600 - 650 lbs were averaged it would establish a standard to which other feeders could compare their results.

"At present," Ross Procter observes, "Blue Tag data is rather difficult to interpret by individual breeders, but if averages were reported each year, it would serve as a yardstick, something like the B.C.A. ratings used in the dairy industry.

"From our results to date, I would say that growth rate and carcass quality are individual traits rather than breed characteristics. Group performance tests combined with Blue Tag carcass data are useful in identifying the meaty, high gaining individuals in any breed.

Ross Procter, livestock breeder, and W. Outhwaite, Livestock Division officer, Kitchener, Ont., discuss selection of sires and dams.

"As Shorthorn breeders, we are encouraged to find individual Shorthorns compete quite favorably in our test groups with individuals from most breeds and crosses that we have tested."

About 20% of the tags purchased by Bodmin have been lost at the packing plant. Ross Procter believes that plant personnel must be sold on the value of the program to the entire industry if this situation is to be corrected.

"Cattlemen must be in a position to produce the type of carcass demanded in a changing market," he warns. "More sophisticated carcass and performance records will give the producer the knowledge and skill he requires to select the best sires and dams to do the job." ■

ROOT-LESION NEMATODES IN POTATOES

J. KIMPINSKI and
R. LONGMOORE

Les chercheurs du ministère de l'Agriculture du Canada et les agents de la Division de la protection des végétaux coordonnent leurs efforts pour évaluer la menace causée par le nématode des racines dans les terres à pommes de terre.

Potatoes are grown on approximately 25 thousand hectares of land in Prince Edward Island. Much of this crop is exported as seed to Latin America and southern Europe. Plant diseases such as late blight, insects and viruses are recognized causes of reduced yields. However, there is increasing evidence, based on recent studies in Wisconsin and New York, that root-lesion nematodes are also involved in potato yield losses in North America. These worm-like animals, approximately one-fortieth of an inch in length, invade the roots of potatoes where they feed on plant tissue. When the numbers of root-lesion nematodes are high, damage to root tissue may occur.

The Plant Protection Division of Agriculture Canada conducts an annual survey in Prince Edward Island for the potato-cyst or golden nematode, *Heterodera rostochiensis*. This nematode species is capable of causing severe losses in potatoes, and all countries importing plant material prohibit its entry. The survey has been in effect for five years, and no golden nematodes have been isolated to date.

In 1973 and 1975, in conjunction with the golden nematode survey, potato roots and soil were examined for the presence of other nematode species. Root-lesion nematodes in the genus *Pratylenchus* were the most numerous plant-parasitic nematodes and were recovered in greater numbers than from other potato growing regions of North America. Several fields in Prince Edward Island had counts of over 14,000 root-lesion nematodes per kilogram of soil.

Linda Whiteway and Claude Gallant sampling a potato field for root-lesion nematodes.

Although several genera and species of plant-parasitic nematodes were recovered, only root-lesion nematodes were prevalent enough to possibly influence yields in Prince Edward Island. Two species of root-lesion nematodes were identified in potatoes; *Pratylenchus crenatus* was found primarily in Sebago, while *P. penetrans* was more common in Kennebec and Superior varieties.

Pratylenchus spp. have also been recovered in other surveys in the province from forage legumes, grasses, vegetables, cereals, corn, tobacco, small fruits and numerous weed species. Forage legumes, grasses and cereals are the usual rotation crops with potatoes in Prince Edward Island.

Root-lesion nematodes are obligate plant-parasites that invade and feed on cortical root tissue. Their survival time in soil in the absence of a suitable plant host is short, though they can live for many weeks when soil temperatures approach 0°C. Occasionally, when nematode populations are very high, tubers are invaded. No nematode infested tubers have been recovered in Prince Edward Island. Therefore, it is unlikely that viable root-lesion nematodes are carried on seed potatoes. Even if some nematodes did adhere to the surface of tubers, they would soon die from desiccation when exposed to air.

Preliminary experiments using radioactive tritium have shown that *P. penetrans* inhibits the movement of water in potato roots and stems. The Atlantic region of Canada usually has sufficient annual rainfall for potato production. However, there is often a dry period in midsummer of one to three weeks. During this interval of moisture stress, interference with water transport by nematodes could delay tuber formation and development, and decrease yields.

Nematicide studies are being initiated to determine the effect of root-lesion nematodes on potato yields under field conditions. Laboratory studies are under way to investigate the pathogenicity of *Pratylenchus crenatus* and *P. penetrans* in different varieties. ■

Dr. Kimpinski is a nematologist at the CDA Research Station, Charlottetown, P.E.I.; Mr. Longmoore is an agricultural officer with the Plant Protection Division, Charlottetown, P.E.I.

SOIL MOISTURE INFLUENCE ON POTATO WART DISEASE

MICHAEL C. HAMPSON

La galle verruqueuse, une maladie transmise par le sol, est endémique à Terre-Neuve. A la Station fédérale de recherches agricoles de Saint-Jean des essais en serre, sous irrigation, ont été réalisés pour étudier l'influence de l'humidité du sol sur le champignon pathogène.

In the 1973 Winter issue of Canada Agriculture we discussed current experimental work on the control of potato wart disease at the St. John's West Research Station in Newfoundland. Tubers disfigured by the disease are shown in Figure 1. One control method mentioned was treatment with systemic chemicals which are absorbed by plants and transported to the places on stem, shoot and root where pathogens attack (infection courts). This treatment, however, produced very erratic results, casting doubt on the efficacy of chemical treatments and on our ability to simulate disease-causing conditions in the greenhouse.

Accordingly, attention was directed to some of the environmental conditions that influence development of the disease. This article describes one of these conditions, and discusses the practical value of some of our findings.

ED. NOTE: Wart Disease or "Canker" of potatoes is endemic in Newfoundland but is not present in other Provinces of Canada. The spread of this disease from Newfoundland is prevented by enforcement of Plant Quarantine Regulations administered by Agriculture Canada's Plant Protection Division.

Dr. Hampson is a plant disease specialist at the Research Station, St. John's West, Newfoundland

Many potato growers have observed a bad wart year is associated with excessive spring or fall rains, and dry seasonal conditions are usually followed by light infections. Precipitation recorded over the past 25 years at the Research Station is approximately equal to optimum precipitation requirements for potato wart development. The heaviest precipitation occurs in the June-September period and in 1975, for example, this amounted to 600 mm, and annually to 1300 mm.

To understand the potential of the relationship of the disease to water, bear in mind that the wart disease fungus resides in soil as tiny, ball-shaped sporangia (Figure 2). As a sporangium germinates it releases about two hundred swimming spores (zoospores). The zoospores initiate infection by penetrating the sub-surface growing points (sprouts, eyes, stolon buds). Soil water, therefore, functions by:

- Providing a liquid medium for germination;
- Supplying a water film connecting zoospores with infection courts;
- Furnishing a vehicle for chemical signalers to guide zoospores to plants.

To find out which watering systems would provide water to fulfill these functions, several patterns of

Figure 1. Potato warts disfigure tubers.

greenhouse watering were developed. They consisted of applying water at the rate of more than 1 liter/min/2 m² for 1, 2 and 3-week periods to potato plantings in benches of infested soil. The watering schemes were designed to:

- Provide excess water for different periods of weeks at different times during the growing season;
- Irrigate daily or at two or three daily intervals;
- Irrigate for different periods of time in the same month or in successive months.

To measure the influences of the different watering patterns, two measurements were used: infected plants

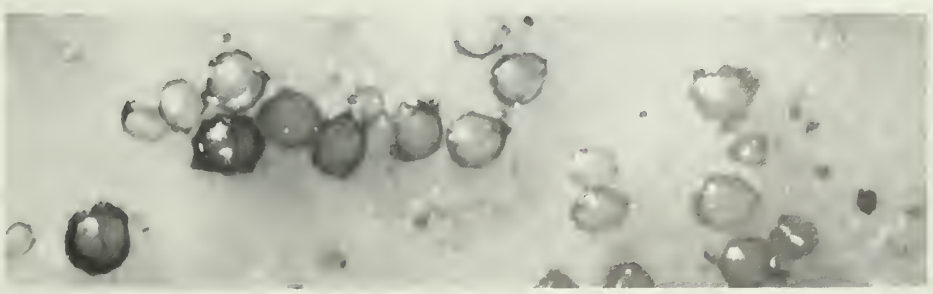


Figure 2. The sporangia of potato wart disease measure about 1/20 mm across

were totalled, this was called 'Percent Infection', and the relative weight of tumour tissue per plant weight were calculated and called 'Tumour Index'.

We expected to find that one particular watering pattern would stimulate consistently 'Percent Infection' and 'Tumour Index' throughout the year. This did not turn out to be the case. Instead, we found that a particular set of watering conditions was associated with abundant tumour tissue production, but the production of tumour tissue fluctuated throughout the year.

The particular set of conditions accompanied by optimum tumour production were:

- Irrigation twice a day to excess;
- Daily irrigation;
- Irrigation for the first 2 weeks after planting.

Water was not a limiting factor in the set of conditions arrived at for abundant disease development, nor, for that matter, was temperature which was monitored throughout the experiments. The only major environmental factor that substantially changed throughout the year was that of the season. Therefore, we plotted 'Percent Infection' and 'Tumour Index' against the months in which the tubers were planted. Two plots are illustrated in Figures 3 (Tumour Index) and 4 (Percent Infection). A pattern of periodicity of infection emerged that was most striking. Three major peaks appeared which roughly coincided with spring, summer and fall. As these peaks did not seem to be influenced by irrigation, it suggested that the limiting factor to infection and tumour development was a mechanism built in the sporangia that responded to the march of the seasons. What we achieved, probably, by optimizing the watering conditions was to allow the fungus to respond more intimately to its built-in germination trigger.

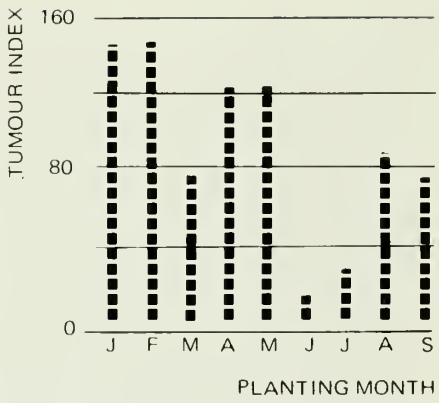


Figure 3 Tumour tissue production at different times of the year when Arran Victory tubers were planted monthly in infested soil.

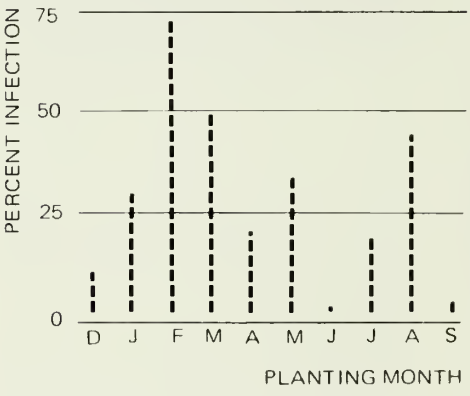


Figure 4. Percent infection of Arran Victory plants at different times of the year.

It was emphasized, earlier in this article, that the fungus is a soil-borne parasite and enters only potato growing tissue. This situation may provide the key to the fungus' behaviour, because seeking susceptible host tissue, which is only produced at certain times in the plant's life cycle in the soil (itself a most hazardous environment) probably requires a highly adapted form of parasitism in which the organism must conserve energies in order to survive and perpetuate itself at the most advantageous times.

In view of these observations, it is very likely that some of our systemic chemical treatments failed simply because they were carried out at the 'wrong' times of the year. To maximize the results and to compare results from one experiment to another, it seems logical to carry out the experiments at the three most susceptible seasonal periods when the fungus appears to be most active. Although this would limit the output of an experimental program, it would conserve materials and man power, reduce wastage, and allow meaningful comparisons to be made between different treatments. The results also suggest that field drainage should be carefully attended to during the three periods in attempts to control and limit available water. Wet soils at the times when susceptible tissue is produced are bound to exacerbate potato wart disease development. ■

BLOSSOM HARVEST

E. R. SMITH

La production de miel canadien augmente grâce à une bonne commercialisation et à une bonne gestion qu'épaule et des normes de qualité uniformes.

Canada produces well over fifty million pounds of honey a year, valued at more than twenty million dollars to the producer. It finds a ready market in many foreign countries because of its fine quality. Although we import a considerable volume of honey annually, our exports far exceed the imports.

Nearly all honey produced in Canada is blossom honey, gathered by honeybees from the nectar of flowers. It may range from almost water white to very dark amber, depending on the floral source. Canadian honey is predominantly light in color and comes from the various clovers, alfalfa and rape grown extensively in this country. Darker honeys come from wild flowers including goldenrod, asters and buckwheat.

The Canadian beekeeper may extract, strain and pack his honey in glass jars or containers made of plastic or metal. He may sell it on his own premises directly to the consumer. The producer may also sell packed honey through local markets, retail stores or larger chainstores. By far the greatest volume is shipped in bulk containers to honey cooperatives or private packers to be uniformly graded and packed in retail size containers for sale in Canada or to be shipped in international trade.

Mr. Smith is in the Agriculture Canada Processed Products Section, Fruit and Vegetable Division, Ottawa.

Following extraction from the comb, most honeys will crystallize in time, some more readily than others. Honey that granulates naturally generally has a coarse or gritty texture. Crystallized honey may be melted, using moderate heat if liquid honey is desired. Once reliquefied, honey will usually remain free of crystals for several months. Liquid honey may also be seeded with finely granulated honey and held at ideal temperature until completely granulated. Such honey is sold as "Creamed Honey". It spreads easily, and has a smooth, fine texture.

The Honey Regulations establish grade standards under the Canada Agricultural Products Standards Act and are administered by the Fruit and Vegetable Division, Production and Marketing Branch. Canada grade names may be used by packers who are registered with the Department. Only honey that has been graded according to the Canada grade standards and is packed and marked in compliance with the Honey Regulations may be shipped from one province to another in consumer size containers or exported from Canada.

The Canada grades are based on such factors as moisture content, freedom from foreign material, water insoluble solids, flavor and aroma. Additional grade factors apply if the claims "Liquid" or "Creamed" appear on the label. Liquid honey is graded on the basis of clarity, brightness and freedom from visible crystals. Creamed honey is graded according to the completeness and uniformity of the granulation and the fineness of its texture. Honey that is not declared to be either liquid or creamed may be completely liquid or partly to completely crystallized.

Honey may contain active yeasts which can cause it to ferment, particularly if the moisture content is over 17.8 percent. Yeasts are readily destroyed by heat, but excessive heat may diminish the quality and darken the color. Pasteurizing plants that are registered and inspected by the Department have approved equipment for the rapid heating and cooling of the honey as well as adequate cold storage facilities. The word "Pasteurized" may be used to describe honey only if it was packed in a registered pasteurizing plant. Pasteurized honey must meet the same criteria for freshness and quality as all other honey sold in Canada. ■

OPERATIONAL RESEARCH IN INDIA — ONE EXPERIENCE

S. FREYMAN

Un membre de l'équipe canadienne associée au Programme de cultures sèches en Inde relate son expérience dans l'application en vraie grandeur des résultats de la recherche dans la région de Hyderabad.

Operational research is a process of testing promising findings under actual farm conditions to determine how practical and profitable they are. Both the farmer and the scientist benefit — the former is exposed to the latest research findings and the latter to the needs and problems of practical agriculture.

In India, the communications gap between farmers and agricultural scientists is wide. The staff of the 'All India Coordinated Research Project for Dryland Agriculture' (commonly known as the Dryland Project) have recognized this and have recently initiated a number of Operational Research Projects.

Before this organized effort, scientists of the Dryland Project undertook, individually, to test findings about which they felt confident and enthusiastic, on farmers' fields. One such experience is described here.

I joined the Canadian team with the Dryland Project in December 1973. In 1974, I devoted much of my time to intercropping systems with Dr. Ch. Krishnamoorthy, S. L. Chowdhury, and Dr. J. Vankateswarlu of the Indian team. Replicated experiments were conducted at the Hayatnagar experimental farm near Hyderabad. Farmers' practices were observed in various parts of the country.

Dr. S. Freyman is a crop physiologist (cold tolerance) at the Agriculture Canada Research Station, Lethbridge, Alta.

Supervised seeding with a woman dibbling fertilizer into a furrow followed by a boy pulling a block of wood to cover the fertilizer with a layer of soil. Another woman (not in picture) then dibbled sorghum seed into the same furrow, which was covered by the plow as it opened a furrow adjacent to the one seeded. No fertilizer was applied to the furrows seeded to pigeon pea.

Intercropping is the traditional practice in India. Two or more different crops are grown together in separate rows to minimize risk. The mixture includes a 'stable component', or crop that is not subject to complete loss due to drought or pests. The proportions of the crops are often determined by the dietary preferences of the farmer and his family, and not agronomic potential.

Dryland Project experiments on intercropping have indicated that production from a unit area of land can be increased, compared to a single crop or traditional intercropping practices. Traditionally, farmers grow one row of an intercrop to every 12 or more rows of a cereal. For maximum production, close attention has to be paid to the proportions and population densities of the component crops. This aspect is generally not appreciated by farmers.

In 1975, I introduced a modified intercropping system near the Hayatnagar Station. Two 0.5-ha (1.2-ac) plots in two farmers' fields were selected. The farmers owned more land than the average holding and only tools and resources available on those farms were used.

From research plots, I had found that sorghum *(Sorghum bicolor)* intercropped with pigeon pea *(Cajanus cajan)* was superior to other crop combinations. I had also learned that, for maximum production, intercrops should be grown at the same population density as when grown alone. For sorghum, the recommendation is 150,000 plants/ha and for pigeon pea, 60,000 plants/ha. I found that two rows of sorghum alternated with one row of pigeon pea was the best planting pattern. In this proportion, sorghum yielded slightly less than when grown as a sole crop. Pigeon peas yielded considerably more than they

would if grown every thirteenth row. The surplus provided more peas than the household requirement of the farmer and his family and could be regarded as a cash crop.

I chose an early (100-day) sorghum, variety '370', and a medium duration (150-day) variety of pigeon pea, Hy 2. Sorghum is a fast growing crop while pigeon pea grows slowly at first. Thus, for a large part of the growing season, there is little competitive effect. After the sorghum is harvested, pigeon pea takes soil moisture from below the rooting depth of sorghum. It extends its flowering branches, and effectively utilizes the site for the remainder of the growing season.

The plots were located on red soils of the Deccan. They are low in nitrogen and phosphorus but high in potassium. Sorghum responds well to the application of N and P, while pigeon pea does not. Consequently, 30 kg of N and 30 kg of P/ha were applied only to the rows of sorghum.

Because of the size of the farms, the two farmers had to rely on hired labor for seeding. I organized the crew so that one woman dibbled fertilizer into a furrow immediately after it had been opened by a pair of bullocks pulling a wooden plow. Following her was a young boy pulling a wooden block on a string to cover the fertilizer so that it would not come into direct contact with the seed. Finally another woman dibbled sorghum seed into the furrow, which was then covered by the plow as it opened an adjacent furrow.

The land owners did surprisingly little supervising. The sowers had to be persuaded to stop walking as they refilled their hands with seed from a pouch, and to take more care in achieving the desired seeding rate. Seeding 'behind the plow' leaves much to be desired because depth of seeding is highly variable. However, this is a common practice in many parts of the Deccan, and it could not be changed immediately.

Seeding of the plots was completed after a few hours of continuous supervision. The crews then continued to seed the rest of the field. They chose to retain the two rows of sorghum to one row of pigeon pea but, at both farms, they abandoned the method of fertilizer application and the care in seeding. The difference between the plots and the rest of the fields was startling. The farmers' fields had about half the stand of the supervised plots. The banded fertilizer had a marked effect on seedling vigor, but differences due to fertilizer were less noticeable later in the season.

Prolonged monsoon rains caused the sorghum grain to deteriorate before it could be harvested. However, based on the stand and vigor of both plots, the yields should have been at least 20 q/ha (1784 lb/ac). The farmers' fields would not have been better than 5 q/ha (446 lb/ac). Pigeon pea yields were 7.6 q/ha on the supervised plots and 1.7 q/ha on the unsupervised fields.

The weakest links in the chain were the sowers. At both farms, they were paid less than 50¢ per day. Furthermore, many of the laborers had small holdings that they tended each day after working on the larger farm. Crops on the small holdings were very poor, probably because the laborers were too

Unsupervised seeding with a woman dibbling seed in furrows opened by wooden plows. Depth is not controlled in this method of seeding and, by the time the seed is covered, the soil in the furrows has dried considerably.

tired to do a good job or because the timing was wrong. It would be interesting to repeat the project with a farmer small enough to perform all his own tasks, but big enough that he did not have to supplement his income by working for somebody else.

The large farmers were reluctant to insist on more care in seeding. The only explanation is, that even in India, with its high population and labor-intensive farming, there is a labor shortage during seeding and harvest. Bigger land owners can't be too demanding since the laborers can find other work. In addition, no extension effort is aimed at the laborers who perform all the functions of raising a crop.

India is a diverse country with large differences in social structures and farming methods, even between neighboring villages. Probably no two experiences would be alike. Nevertheless crop stands throughout the Hyderabad region are generally poor which leads to the suspicion that similar situations may not be uncommon. Only after all the implications in crop production in India are better understood will it be possible to apply promising research findings to practical farming. ■

Stands from supervised seeding (a) and from careless, unsupervised seeding (b) in adjacent parts of the same field.

CANAL LINING FOR SEEPAGE CONTROL

T. G. SOMMERFELDT

La station de Lethbridge fait l'essai d'un appareil permettant de rendre imperméable les côtés des fossés d'irrigation empêchant ainsi les pertes par infiltration.

Soil salinity is increasing and becoming a serious threat to continued production on the irrigated soils of southern Alberta.

Dr. Sommerfeldt is a drainage engineer at Agriculture Canada Research Station, Lethbridge, Alta.

An estimated 15 percent of the irrigated land has become non-productive because of salinity and high water tables. About 75 percent of this loss is caused by seepage from canals and ditches. Thus, control of seepage would greatly reduce the problems of salinity and waterlogging.

At the Lethbridge Research Station, we are attempting to develop an effective and economic canal lining to control seepage. Various materials have been tested for effectiveness in seepage control, resistance to erosion, cost, and ability to withstand freezing, thawing, and weathering.

A lining that is made by incorporating an anionic asphalt emulsion, bentonite (a clay material), and a wetting agent into the soil has worked well in the laboratory. The lining was installed on 1700 feet of ditch in late autumn 1975 and 2600 feet in August 1976 and is now being field tested.

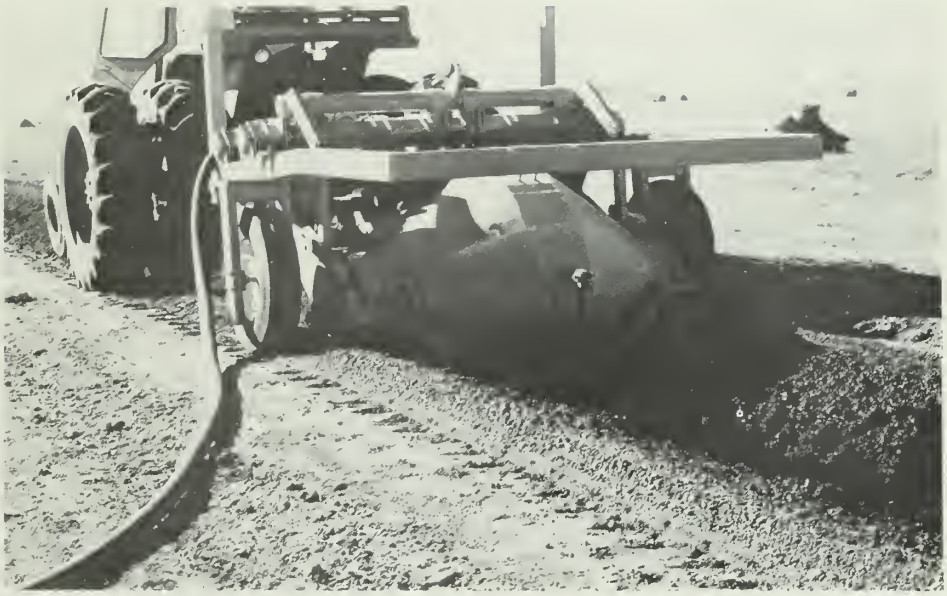
The lining has several positive values: It can withstand some flexing from frost action without

Water running in the ditch about 10 days after installation of lining.

cracking, it is less expensive than concrete, and herbicide can be incorporated into the lining for effective weed control. However, because of its softness, the lining will be damaged by livestock.

To facilitate field testing, a machine has been built to incorporate the materials into the soil. It is essentially a large drum-shaped rototiller shaped to fit the canal. All the ingredients are applied just ahead of the incorporator, and are thoroughly mixed with the soil as the incorporator moves slowly down the canal. The mix is distributed over the surface of the canal by the action of the rototiller and a shield on the cover of the incorporator. The lining is then packed, using a drum packer, which is also the same size and shape as the canal. If the lining proves effective in the field, it is expected that the incorporator and the packer will serve as prototypes of machines for practical installation of the new lining.

The incorporator and packer were designed by N. B. McLaughlin at the Swift Current Station. The formulation of the lining mixture was done by Dr. T. G. Sommerfeldt at the Lethbridge Research Station. ■



Rear view of incorporator with shield in place. Hose leads to asphalt tanker.

Packer in foreground and incorporator in background. Incorporator is not in operation.

LA SURVIE DES PLANTES À L'HIVER PEUT-ELLE ÊTRE PRÉDITE À L'AVANCE?

ROGER PAQUIN

The conditions and factors that influence the winter survival of plants are described and show that it is difficult to forecast. Several research scientists at the Research Station at Sainte-Foy have investigated the effects of some factors that can be controlled, and others that can't.

Prédire la survie des plantes à l'hiver, c'est rechercher les principaux facteurs de survie et mesurer leur impact dans le temps.

On peut classer les facteurs en deux catégories: ceux, inhérents à la plante tels sa capacité à s'endurcir au froid, sa morphologie, son état de santé, la nutrition minérale et les pratiques culturales, et ceux qui relèvent du climat et du sol tels la température de l'air et du sol, le drainage, les précipitations de pluie et de neige, et, dans une certaine mesure, le vent.

Depuis quelques années, les chercheurs de la Station de Recherche de Sainte-Foy essaient de déterminer le degré d'influence de quelques-uns de ces facteurs sur la survie à l'hiver de la luzerne, surtout ceux qui relèvent de la plante et du sol, tels l'endurcissement au gel et l'humidité du sol, facteurs sur lesquels un certain contrôle demeure possible. Quant aux facteurs climatiques, ils se contentent de les observer et d'en mesurer les conséquences sachant qu'actuellement ils échappent au contrôle de l'homme.

Certes, il est facile de vérifier durant l'hiver si une plante est encore vivante. Il suffit d'extraire un échantillon de plante d'un sol gelé que l'on place dans une serre. Quelques jours plus tard, l'éclatement des bourgeons et la présence de feuillage ou leur absence donnent la réponse. Ce test, même utile, n'est pas suffisant pour prédire la survie. Il ne nous renseigne pas sur les causes déterminantes permettant à la plante de reprendre vie au printemps.

Parmi les facteurs énumérés plus haut, certains sont plus déterminants que les autres et leur influence plus prépondérante: ce sont la température de l'air et du sol, les précipitations de pluie ou de neige, le drainage, l'humidité du sol et le degré d'endurcissement de la plante au moment du gel. Si l'on s'en tient à l'ordre chronologique des évènements, c'est ce dernier facteur qui arrive en tête de liste.

Les températures proches de 0°C en automne et la courte durée du jour permettent à la plante de s'endurcir. Pour la luzerne, le seuil de résistance est de −14 à −16°C. Le seuil de résistance (DL 50) est la température où la moitié de la population meurt. Au Québec, les basses températures qui favorisent l'endurcissement de la luzerne surviennent généralement en octobre. Si le gel arrive subitement après quelques jours de chaleur, la plante a moins de chance de s'endurcir et, par la suite de lui résister, que si la température se maintient continuellement à 1 ou 2°C. Les années où l'automne est plus chaud, les plantes sont moins endurcies. L'endurcissement dans les conditions naturelles du champ n'atteint jamais celui en phytotron où le seuil de résistance de la luzerne peut atteindre −20 et −22°C.

Si on peut déterminer le degré d'endurcissement de la plante à l'automne, on ne peut pour autant prédire sa survie à l'hiver, car, dans les conditions actuelles, on ne peut prédire quel genre d'hiver elle aura à subir.

La neige offre une excellente protection contre le gel et, en son absence, les chances de survie à des températures de −18 à −30°C sont nulles. A Barston dans les Cantons de l'Est, dans un champ de luzerne où la voirie provinciale avait installé une clôture à neige pour l'empêcher de s'amonceler sur la route, les pertes par le gel n'étaient que de 5% comparativement à 70 et 80% pour le reste du champ. Dans la plupart des régions du Québec, il est rare, cependant, que la neige fasse défaut au moment des froids intenses de l'hiver, soit janvier et février.

Les pluies d'automne et surtout d'hiver modifient considérablement la survie, particulièrement si le drainage fait défaut. Des expériences avec la luzerne ont démontré que le seuil de résistance s'abaissait de 4 à 5°C tant chez les plantes endurcies que non endurcies dans un sol relativement sec comparé à un sol saturé d'eau. Cet effet de sécheresse s'additionne donc à celui des basses températures pour permettre une meilleure résistance au gel. On peut en déduire que de fortes pluies d'automne qui saturent le sol, surtout où le drainage fait défaut, diminuent considérablement les chances de survie.

Il arrive assez fréquemment dans certaines régions de la Province, particulièrement autour de Montréal, qu'un réchauffement subit du climat, que de fortes pluies ou que le vent fassent disparaître la neige en hiver ou au début du printemps. L'eau s'accumule et gèle sur le sol gelé, si le drainage n'est pas satisfaisant. Cette couche de glace, con-

Dr Paquin est phytophysiologiste et Chef de la Section de Physiologie et de Biochimie à la Station de Recherche, Agriculture Canada, Sainte-Foy, Québec.

ductrice du gel, endommage souvent les collets. Si le temps doux ou la pluie persiste, les premiers centimètres du sol peuvent dégeler. Les collets peuvent alors perdre une partie de leur résistance et être endommagés par les gels subséquents. Un test de survie en janvier ou février aurait démontré que la plante était encore bien vivante, mais quelques semaines plus tard les prédictions seraient renversées.

Nous ignorons encore jusqu'à quel point les plantes sont affectées par les pluies de printemps et la fonte des neiges, surtout là où l'eau séjourne longtemps en surface. Certains prétendent que la submersion par l'eau peut causer l'asphyxie des racines et la mort de la plante. Le printemps dernier, nous avons observé que partout où l'eau avait séjourné en surface, la mortalité était beaucoup plus élevée que là où le drainage est efficace. Les plantes prélevées dans les endroits submergés dégageaient une forte odeur d'ensilage, signe d'une fermentation anaérobie avancée. Toutes ces plantes étaient déjà mortes. Que dire du déchaussement des plantes durant la saison hivernale; c'est surtout au printemps qu'on en constate les funestes effets.

Si l'homme peut contrôler certains facteurs tels que l'humidité du sol par le drainage et les pratiques culturales, l'amoncellement de la neige par des barrières et jusqu'à un certain point l'endurcissement de la plante par une régie de coupe appropriée et l'emploi de retardants de croissance, on est encore loin du contrôle de la température et des précipitations de neige ou de pluie, et surtout des moments où elles se produisent. Même si les chercheurs font des progrès dans la prédiction de certaines maladies telles que par exemple, la brûlure tardive des pommes de terre, la tavelure du pommier ou les rouilles des céréales, ils sont encore loin de pouvoir prédire la survie des plantes à l'hiver. Des progrès sont encore possibles mais le but à atteindre m'apparaît lointain. ■

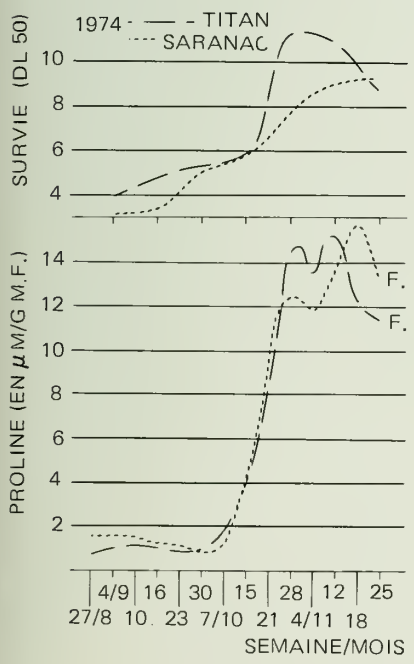


Fig. 1. Prélèvement d'un échantillon de luzerne dans un sol gelé avec une scie à chaîne renforcée de soudure. Photo prise à St-Vallier, Québec, le 31 janvier 1974 par M Jacques St-Cyr.

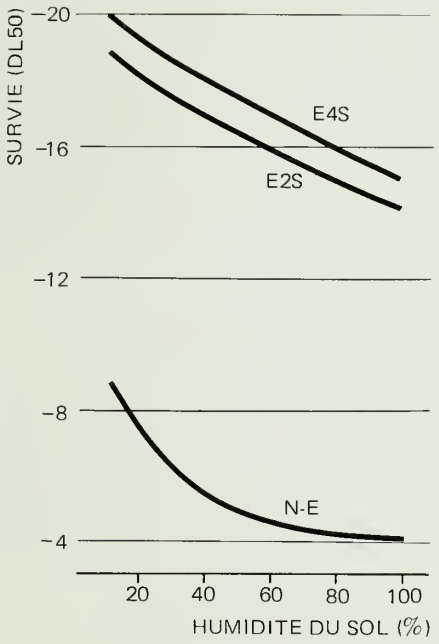


Fig. 2. Endurcissement au gel de la luzerne, variétés Titan et Saranac, et corrélation avec la synthèse de la proline dans les feuilles. L'endurcissement a lieu principalement en octobre et coïncide avec une augmentation de la proline.

PEST CONTROL WITH SEX PHEROMONES

E. A. C. HAGLEY

La Station de recherche de Vineland a effectué des essais visant à réduire le nombre de parasites à des niveaux où ils n'occasionnent pas de dégâts d'importance économique en utilisant des phéromones sexuelles d'insectes. L'auteur décrit les résultats des essais menés de 1972 à 1975 et portant sur la tordeuse à bandes rouges et la pyrale de la pomme.

Synthetic insect sex pheromones or attractants have been used in the past ten years to monitor pest populations in several crops. More recently they have been used to reduce pest numbers below the level of economic injury.

Successful control is based on permeation of the atmosphere with a pheromone in the crop area, making it difficult for males to find and mate with females. The pheromone can be dispersed in the air by spraying, or placed in traps to attract males and thus reduce their numbers.

Synthetic pheromones generally do not compete effectively with wild females at high densities. In some cases, therefore, it is necessary to reduce the pest population with an insecticide before applying the pheromone. Mass-trapping around the periphery of the crop will also help to reduce pest numbers by collecting insects migrating into the treatment area.

Where pheromone traps were used to monitor the red-banded leafroller moth in two orchards on the Niagara Peninsula, the total number of males caught was reduced from 1057 to 134 between 1972 and 1975. No egg masses were found, nor was any larval damage to fruit observed. In another orchard, 816, 74, and 81 male moths were taken in 1972, 1973, 1974, respectively. In 1975, however, the numbers increased to 366. In an adjacent unsprayed block 525, 137, 121, and 367 were caught in the same years. In 1975, 0.2% larval fruit damage occurred in the sprayed block, and 1.9% and 0.3% damage occurred in the unsprayed block in 1972 and 1975 respectively. No egg masses were recovered in either block and damage was probably due to wind borne larvae originating outside the study areas.

In 1975, 15 codling moth traps per acre were set out at the end of May in two 2-acre blocks of apples. In one block (A) the 1st generation was controlled with insecticides while in the second (B), insecticides were only applied later to control the 2nd generation. In a third block (C) no insecticides were applied. Estimates of larval fruit damage at the end of the 1st generation showed 25% in block (C), 13% in block (B), and 0.3% in block (A). These data indicate that reduction of fruit damage due to the spring generation of moths can be reduced by trapping with sex pheromones. More effective control would probably be attained if an insecticide were applied to reduce moth numbers early in the season, since approximately 60-70% of the seasonal damage is done by this generation. ■

Dr. Hagley is Head of Fruit Pest Management at Agriculture Canada Research Station, Vineland, Ont

ECHOES
FROM THE FIELD AND LAB

ECHOS
DES LABOS ET D'AILLEURS

MAKE USE OF LAND Many property owners don't know what to do with their land or buildings, because they are not full-time farmers and don't appreciate the productive value of their resources. What can these would-be part-time farmers do? Well, Agriculture Canada has a publication listing the different alternatives or enterprises that make use of land and buildings. It outlines potential production of horticultural crops, forages, cereals, oilseeds, livestock and poultry enterprises. It shows the relative amount of capital investment, operating expense and management skill or labor involved in each enterprise. Property owners can identify the forms of production that fit their particular circumstances, including time for the job and size of pocketbook.

Write to the Information Division, Agriculture Canada, Ottawa, K1A 0C7 requesting Publication 1574 entitled Small-Scale Food Production.

VIRUS-RESISTANT OATS Red leaf, an aphid-transmitted virus disease of oats, reached epidemic proportions in Ontario, Quebec and parts of the Maritimes last year. Commonly called red leaf or yellow dwarf, the disease also attacks barley and wheat and is properly called the barley yellow dwarf virus. The virus is transmitted to plants by grass-feeding aphids

Agriculture Canada scientists already have a virus-resistant oat variety in their winter breeding program carried out in the Imperial Valley in southern California, where virus-bearing aphids are plentiful.

"The new, resistant variety gets the disease but is not nearly as badly affected by the virus as our standard oat varieties which are susceptible," says plant breeder Vernon Burrows. "I expect the variety will be considered for licensing and it will be given a name at that time."

SEED INCREASE Oxford Oats, developed at the University of Guelph, and licensed by the Plant Products Division in September 1976, have been released to Stewart Seeds, Ailsa Craig, Ontario. Breeder and select seed of this variety were immediately shipped via air freight to Thos. Corson Holdings, Gisborne, New Zealand, for winter multiplication. It will be grown there under the supervision of Dr. Glenn Mortimore, a crop specialist who recently retired from Agriculture Canada's Research Station, Harrow, Ont.

SUSCEPTIBLE VARIETY Stalk smut of fall rye has increased dramatically in southern Alberta over the last three years. Last year it was found in 18 of 46 fields inspected, and in two of these, 33 and 44 percent of the plants were smutted. Only five years ago, this disease was relatively rare. The striking increase in the occurrence and severity of stalk smut has resulted from the wide acceptance of Cougar, a variety known to be significantly more susceptible than five others tested. Field tests at the Lethbridge Research Station over the past five years have shown that seed treatment with the systemic fungicide, Vitoflo, gives excellent control of stalk smut, whether caused by seed-borne or soil-borne inoculum. This product has been registered for the control of stalk smut on rye. Many growers are now treating their seed before sowing fall rye.

ROTATION PAYS The oldest continuous experiment in North America on crop rotations on irrigated land continues to show the advantages of good agricultural practice. An experiment, started in 1910, at the Lethbridge Research Station consists of 10, one-acre plots on which are grown a sequence of barley, oats, three years of alfalfa, wheat, sugar beets, and 3 more years of alfalfa. The practices and varieties used over the years are those recommended to farmers in the area. With most crops, average yields have continued to increase. For example, the barley yield last year was 146.7 bushels per acre, a record which exceeded by two bushels the previous high, set in 1972, but was far above the second highest of 128.8, which was obtained in 1957.

NUT GROWERS British Columbia has a small filbert nut industry in the lower Fraser Valley area. In recent years, Agriculture Canada's Economics Branch Research Division notes, production has averaged 165 tons annually at a farm price of 40 cents per pound. In the late 1960's, production averaged 115 tons and the farm price was 33 cents per pound. There are about a dozen growers in B.C., one-half of whom are full-time producers. Total acreage is around 340, with about 200 considered to be in full production. Larger growers have their own processing equipment. They are represented by the B.C. Nut Growers Association.

The third largest nut producing area in the world is in Oregon and Washington combined, which produced 11,000 tons last year. Turkey and Italy are the largest producers.

SELF-POLLINATED ALFALFA The 70-year-old Professor Emeritus of Genetics at the University of Alberta, Dr. Karl Lesins, has developed a self-fertile alfalfa strain. For farmers in Northern Alberta and Peace River country, it could mean a resurgence of an almost vanished alfalfa seed growing industry because of the difficulty to achieve cross-pollination and seed set in standard alfalfa varieties. Dr. Lesins' work with alfalfa began in his native Latvia and continued at a Swedish plant breeding station where he worked from 1945 to 1951, when he emigrated to Canada. In his 25 years at the University of Alberta he has criss-crossed the Mediterranean area on seven expeditions, amassing the world's most complete collection of information on the medicago family.

An application to license the self-fertile variety will be made to Agriculture Canada's Plant Products Division.

FOLDING MONEY FROM FLAX Normal sources of flax straw in the Dakotas and southern Manitoba are "drying up" because of the encroachment of other crops. However, Statistics Canada have shown a high concentration of flax production in the area northeast of Agriculture Canada's Research Station at Melfort, Sask. A Canadian manufacturer of fine papers such as bible paper, cigarette papers and folding money decided to investigate the availability of the straw, hoping to line up 5,000 tons of it last fall. The company made an offer for baled straw stacked to their specifications. Straw had to be of suitable height, yield and density, and contain a minimum of weeds. Wild oats, a common weed in flax could not exceed 5 percent by weight. The stacks were expected to be processed in the spring, using portable mills.

WHEY PROTEIN An Agriculture Canada scientist has developed a high-protein food additive from the liquid by-product from cheesemaking which has traditionally been dumped down cheese factory drains. Wayne Modler from Agriculture Canada's Food Research Institute in Ottawa says the soluble powder is superior in some ways to skim milk powder and dried whey. It is 35 per cent protein, gels and whips well and doesn't turn dark when heated.

INFORMATION
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